

IFRS Taxonomy Formula Linkbase

Documentation and Guidance

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Date: 2011-09-16

Executive summary

The purpose of this formula linkbase is to improve the data quality of IFRS taxonomy filings and to provide additional guidance for both technical and financial reporting audiences, in order to better understand the IFRS concepts and their meaning. Both financial reporting and technical perspectives will be addressed in each section separately. The formula linkbase can be used with software packages supporting the XBRL formula specification 1.0 (June 22, 2009; including errata corrections as of 2011-03-10) and allows for additional validations of the reported facts. The IFRS taxonomy formula linkbase is developed in a generic manner, which means it can be utilised directly on the filings created, on the basis of the IFRS Taxonomy (instance documents) or the company specific extensions to the IFRS taxonomy (filer extension taxonomy and instance document). Formulae provided in this release should always be seen in the context with other IFRS Taxonomy support materials such as the IFRS Taxonomy Guide (ITG) which is available on the <http://www.ifrs.org/XBRL/Resources/Resources.htm> website.

Disclaimer

The IFRS Taxonomy formula linkbase is a prototype implementation and is released for the purpose of obtaining feedback on its quality and usefulness. When implementing the formulae as described in the following paragraphs, analysis has shown that in some rare situations, the formula specification required minor adjustments, and feedback has been provided to the Formula WG in such cases. If a workaround was needed it is clearly mentioned in this document. Please be aware that the IFRS Taxonomy formula linkbase may be subject to change in the future and described formula groups below may be further extended or dropped.

Business perspective

The objective of the IFRS Taxonomy formula linkbase is to provide additional validation possibilities for the preparers in order to ensure that high quality of facts are reported in their filings. The formula linkbase refers to the business logic of the IFRS Taxonomy, which represents the IFRSs and the IFRS for SMEs. This document allows validation of certain business logic included in the IFRS Taxonomy, which cannot be validated by the means of XBRL schema or calculation linkbase.

All formulae belong to a certain logical grouping. Each group has been identified as a potential quality weakness in real filings data. The groups identified in the initial analysis are listed as follows and can if required, be extended or dropped in future releases:

- Cross period validations – whereas formulae will ensure that calculation of roll-forwards from beginning balance over the total changes over the period equals ending balance.
- Earnings per share validations – whereas formulae will ensure that the EPS calculation of the Profit (loss) and the average number of shares provides correct results.
- Axis aggregation validations – whereas formulae will ensure that members of an axis are calculated to their parent members properly (if applicable for a given axis and only if the filer structured their members in a summation-like hierarchy).
- Fact equivalence validations – whereas formulae will ensure that if two facts are tagged by different IFRS Taxonomy concepts but, conceptually represent the same thing, that they are equal. Usually, one of them is in a dimensional context, whilst the other one is not (e.g. ‘Aircraft’ = ‘Aircraft [member]’ in ‘Property, plant and equipment [axis]’ with primary item ‘Property, plant and equipment’).
- Common accounting equivalence validations – whereas formulae will ensure that general principles of accounting are applied correctly.
- Positive / negative fact validation – whereas formulae will ensure that if a fact is expected to be reported as an amount greater or equal zero it is not negative and vice versa.
- Percentage warnings – whereas formulae will ensure that the format of percentage fact is appropriate according to the XBRL specification.

All these groups are explained in further detail in the corresponding sections.

Technical perspective

It is assumed within this document that the technical audience is familiar with the XBRL formula specification 1.0 (June 22, 2009; including errata corrections as of 2011-03-10) as published by XII.

The purpose of this XBRL formula linkbase is to improve the quality of IFRS Taxonomy filings based on the final IFRS Taxonomy 2011 (release date 2011-03-25). Interim releases which were published after the 2011-03-25 release are currently not supported. The formulae linkbase should not be regarded as a standalone artefact. It should always be considered in the context of the IFRS Taxonomy 2011 and its documentation.

The formula linkbase can be plugged into the DTS of the IFRS Taxonomy 2011, otherwise, only a certain subset of formulae applicable to the individual scenario can be re-used. Each logical grouping as defined in the business perspective section above is stored in a separate physical formula linkbase file. In some scenarios, not all formula groups can be applied. With physical separation by logical group, the reusability is expected to go up. In some cases, this reusable approach requires minor adjustments within the formulae. This is particularly true for taxonomies which extend the IFRS taxonomy 2011. Required adjustments are described in the corresponding section of this document.

Each logical formula grouping is constructed in a way that should be easy to understand. This is achieved through patterns used in the IDs of value assertions and by naming variables in an understandable fashion. It is the view of the XBRL team, that semantic meaning in IDs and variable names or similar practices should be

discouraged. For reasons of development and maintenance, there is currently no alternative approach available with the current tools in the market.

The IFRS Taxonomy formula linkbase consists of the formula type *Value Assertion* as defined in the formula specification of XII only. *Existence assertions* are not included in this implementation. The IFRS standards do require certain disclosures but these do not necessarily all end up in IFRS taxonomy concepts. Therefore, testing the existence of certain IFRS concepts as defined in the IFRS taxonomy in a financial report is not practical. A company always has the option to create their individual concept if they think that the IFRS taxonomy concept is not appropriate.

All formulae apply to implicit filtering of aspects. If this is not otherwise stated through explicit filter units, periods and other aspects as defined within the formula linkbase context must be the same within one validation.

Cross period validation

This group of formulae will ensure that the calculation of roll-forwards from beginning balance over the total changes over the period equals ending balance. All cross period validation formulae are identified through the first part of the Value assertion ID attribute starting with 'crossPeriod_' within the formula linkbase. All cross period validations are stored in the physical file /2011-03-25/formula/for_ifrs-cro_2011-09-16.xml.

Business description: The following example represents the IFRS Taxonomy 2011 illustrative example 1 which is available on IFRS Foundation website to explain the basic mechanics of this formula group.

	20x2	20x1
	CU	CU
Revenue	6,863,545	5,808,653
Cost of sales	(5,178,530)	(4,422,575)
Gross profit	1,685,015	1,386,078
Other income	88,850	25,000
Distribution costs	(175,550)	(156,800)
Administrative expenses	(810,230)	(660,389)
Other expenses	(106,763)	(100,030)
Finance costs	(26,366)	(36,712)
Profit before tax	654,956	457,147
Income tax expense	(270,250)	(189,559)
Profit for the year	384,706	267,588
Retained earnings at start of year	2,171,353	2,003,765
Dividends	(150,000)	(100,000)
Retained earnings at end of year	2,406,059	2,171,353

The formula group validates all positions in the taxonomy where there is the following correlation:

beginning balance + change = **ending balance**

In the example above the formula will be applied twice, once for 20x2 and a second time for period 20x1.

Technical description: A cross period validation is implemented when there is a beginning and ending balance in the IFRS presentation linkbase (including their negations). Those are indicated through the preferredLabel attribute on a presentation arc and have the preferredLabel attribute values 'http://www.xbrl.org/2003/role/periodStartLabel', 'http://www.xbrl.org/2003/role/periodEndLabel', 'http://www.xbrl.org/2009/role/negatedPeriodStartLabel' or 'http://www.xbrl.org/2009/role/negatedPeriodEndLabel'.

Beginning and ending balance are always linked through the same parent within the presentation linkbase. The actual change is represented though multiple elements in between. Those changes can be summarised at the end which is indicated through a Total label. It is possible to have multiple changes (e.g. the formula *crossPeriod_RetainedEarnings*).

In the formula, the beginning balance is stored in the fact variable called 'beginningBalance', the changes during the year are stored in the fact variable called 'change' and the ending balance is stored in a fact variable called 'endingBalance'.

The validation returns true if the following condition is met (and false otherwise):

beginning balance + change = ending balance

Please note that from a technical perspective, the Instant-Duration Filter in the beginning- / ending-balance fact variables ensures that only facts with appropriate dates are added up.

Additional formulae can be added to this group when there is a similar situation in the IFRS taxonomy extension either on a regulator or company extension level.

Earnings per share validations

This group of formulae will ensure that the EPS calculation of the Profit (loss) and the average number of shares provides correct results.

All Earnings per share validation formulae are identified through the first part of the Value assertion ID attribute starting with 'eps_' within the formula linkbase. All EPS validations are stored in the physical file /2011-03-25/formula/for_ifrs-eps_2011-09-16.xml. There are six EPS validations implemented in the formula linkbase which are derived from the extended link role '[838000] Notes – Earnings per share'. They are listed in detail below and return true if they add up and are false otherwise:

Business description: The earnings per share formulae provided within this linkbase are based upon the standard label as listed below:

Basic earnings (loss) per share from continuing operations = Profit (loss) from continuing operations attributable to ordinary equity holders of parent entity / Weighted average number of shares

Basic earnings (loss) per share from discontinued operations = Profit (loss) from discontinued operations attributable to ordinary equity holders of parent entity / Weighted average number of shares

Basic earnings (loss) per share = Profit (loss), attributable to ordinary equity holders of parent entity / Weighted average number of shares

Diluted earnings (loss) per share from continuing operations = Profit (loss) from continuing operations attributable to ordinary equity holders of parent entity including dilutive effects / Adjusted weighted average number of shares

Diluted earnings (loss) per share from discontinued operations = Profit (loss) from discontinued operations attributable to ordinary equity holders of parent entity including dilutive effects / Adjusted weighted average number of shares

Diluted earnings (loss) per share = Profit (loss), attributable to ordinary equity holders of parent entity including dilutive effects / Adjusted weighted average number of shares

In some scenarios this assumption is nevertheless incorrect especially if reported numbers are getting larger. A filer may report the following numbers:

Basic earnings (loss) per share from continuing operations	0.79
Profit (loss) from continuing operations attributable to ordinary equity holders of parent entity	1,641,000,000
Weighted average number of shares	2,069,804,000

The above validation rule would return false based on the fact that

$$\frac{1641000000}{2069804000} = 0.79282869\dots$$

And therefor is not equal to 0.79.

In this scenario, it is preferred to have a parameter which indicates the accuracy of the calculation. In order to achieve this, the above calculations are re-written which results in the following mathematical expression which is used in the formula linkbase instead of the above calculations:

abs(('Profit (loss) from continuing operations attributable to ordinary equity holders of parent entity' div 'Weighted average number of shares') - 'Basic earnings (loss) per share from continuing operations') <= 0.1

Technical description: The variables are called 'eps', 'profitLoss' and 'averageShares'. Please note that from a technical perspective, the Unit single measure Filter ensures that the correct units are used on all corresponding facts.

The current precision of 0.1 can be adjusted if required. Similar precision expressions can be also adopted by other formula groups if required.

Axis aggregation validations

This group of formulae will ensure that members of an axis (dimension) are calculated to their parent members properly (if applicable for a given axis and only if the filer structured their members in summation-like hierarchy).

All dimensional aggregation validation formulae are identified through the first part of the Value assertion ID attribute starting with ‘DimAgg_’ within the formula linkbase. All axis aggregation validations are stored in the physical file /2011-03-25/formula/for_ifrs-axi_2011-09-16.xml. The validation adds up all children in a given dimension and compares the value to the parent fact value. The validation returns true if both fact values are equal or otherwise false. This aggregation is performed on monetary concepts only.

There is a validation for each ELR and for each dimension defined in the IFRS taxonomy. Validations for the IFRS for SMEs taxonomy contain the postfix string ‘_sme’ at the end of the value assertions id attribute and respectively, in the postfix string ‘_full’ in the IFRS full taxonomy value assertions.

Business description:

For example ‘*Property, plant and equipment [axis]*’ consists of a certain hierarchy of members:

Disclosure of detailed information about property, plant and equipment [table]	table	IAS 16.73 Disclosure
Classes of property, plant and equipment [axis]	axis	IAS 16.73 Disclosure
Property, plant and equipment [member]	member [default]	IAS 16.73 Disclosure, IAS 17.31 a Disclosure, IAS 36.127 Example
Land and buildings [member]	member	IAS 16.37 b Example
Land [member]	member	IAS 16.37 a Example
Buildings [member]	member	IAS 16.37 Common practice
Machinery [member]	member	IAS 16.37 c Example
Vehicles [member]	member	IAS 16.37 Common practice
Ships [member]	member	IAS 16.37 d Example
Aircraft [member]	member	IAS 16.37 e Example
Motor vehicles [member]	member	IAS 16.37 f Example
Fixtures and fittings [member]	member	IAS 16.37 g Example
Office equipment [member]	member	IAS 16.37 h Example
Tangible exploration and evaluation assets [member]	member	IFRS 6.25 Disclosure
Construction in progress [member]	member	IAS 16.37 Common practice
Other property, plant and equipment [member]	member	IAS 16.37 Common practice

Facts reported for the concept ‘*Property, plant and equipment*’ in their dimensional qualification of the members from the ‘*Property, plant and equipment [axis]*’ are supposed to be totalled up (rolled up) according to the defined hierarchy.

The current formula implementation is not able to calculate missing concepts which are in the middle of a role up. The following scenario would be marked as an error because the ‘*Land and buildings [member]*’ is not reported (see below). The resulting validation would only check the role up ‘*Property, plant and equipment [member]*’ = ‘*Machinery [member]*’ which is not equal.

	<i>Property plant and equipment</i>
Property, plant and equipment [member]	100
Land and buildings [member]	<i>[Not reported]</i>
Land [member]	50
Buildings [member]	25

Technical description: The parent fact value is stored in the fact variable ‘*parent*’ and all its children are stored in the fact variable ‘*child*’. In some cases there are exceptions defined for a dimension where the parent is not the summation of its children. Those exceptions are expressed through an additional explicit dimensional filter in the parent variable which is flagged as ‘complement’ (e.g. ‘*dimAgg_BusinessCombinationsAxis_full_1*’).

Please note that due to restrictions on the explicit dimensional filter as defined in the formula specification, it is required to state each ELR in which the dimension is used explicitly. This is stated in the explicit filter found in the ‘*child*’ variable in `df:explicitDimension/df:member/df:linkrole/text()`. This results in multiple formulae for each dimensional role up. The Formula WG is currently adding a more generic mechanism which would result in much less formulae with equivalent content coverage. Unfortunately, this development is not yet done, and there is no known implementation supporting this scenario at the time this document was written. Therefore, a more generic approach may need to be considered for future formula implementations in order to reduce the amount of formulae and improve reusability.

In an open filing scenario (like in the US), the definition for ELRs is usually individual strings defined on the filer level and so vary from filing to filing. They are unknown to the regulatory body prior to submission. A regulatory body in an open filing scenario cannot estimate or predict the ELRs used by the filer and therefore cannot create adequate formulae covering this use. In an open filing scenario this formulae group is useful for filers only in order to improve their data quality prior to submission. In a template approach, where the filer has to reuse the definition linkbases as provided by the regulatory, the regulatory body can re-use this formula group as described below.

In order to re-use this formula grouping, a filer can only re-use the structure of the formulae and use it as a template. For every dimension and for each ELR where this dimension is used, the filer has to create an individual formula. Each formula must state the dimension in the `df:explicitDimension/df:dimension/text()` value and the ELR in the `df:explicitDimension/df:member/df:linkrole/text()`. This only applies to the explicit dimension filter in the ‘*child*’ variable.

Fact equivalence validations

This group of formulae will ensure that if two facts are tagged by different IFRS Taxonomy concepts but, conceptually represent the same thing, that they are equal. Usually, one of them is in a dimensional context, whilst the other one is not (e.g. ‘*Aircraft*’ = ‘*Aircraft [member]*’, in ‘*Property, plant and equipment [axis]*’ with primary item ‘*Property, plant and equipment*’).

All fact equivalence formulae are identified through the first part of the value assertion ID attribute starting with ‘*equ_*’ within the formula linkbase. All fact equivalence validations are stored in the physical file `/2011-03-25/formula/for_ifrs-equ_2011-09-16.xml`. Their purpose is to make sure that dimensional and non-

dimensional facts with the same semantics contain the same number even though they are two separate concepts.

Business description: In a financial report, the same fact is sometimes tagged twice at different places in the report. E.g. a position called 'Retained earnings' which is used in statement of financial position, is equivalent to a position Equity qualified by 'Retained earnings [member]' on 'Components of equity [axis]' in the statement of changes in equity. In the IFRS taxonomy, this is implemented through two different (one dimensionally qualified and another one which is not dimensionally qualified) concepts (for architectural reasons) even though they are semantically the same. One concept is the place holder for a non-dimensional context, and the other concept is used for dimensional constructs. Fact equivalence validations check for all such situations, if those facts hold the same value.

Technical description: The distinction between dimensional and non-dimensional concept is required in the first place due to architectural agreements within the ITA group. The non-dimensional fact is always in the fact variable 'non-dim', whereas the dimensional data point in the corresponding hypercube is stored in the fact variable 'dim'. The formulae will only be evaluated if numbers are reported on both positions in the taxonomy.

It may be appropriate to adjust the formulae and include rounding or a certain precision parameter. Those mechanisms can be adopted in a similar fashion as described in the section 'EPS validations'.

Common accounting equivalence validations

This group of formulae will ensure that basic accounting principles like Assets = Liabilities + Equity hold true. Further logical validation checks are possible as discussed in the paragraph below.

All common accounting equivalence formulae are identified through the first part of the value assertion ID attribute starting with 'cae_' within the formula linkbase. All common accounting equivalence validations are stored in the physical file /2011-03-25/formula/for_ifrs-cae_2011-09-16.xml.

Business description: In this release this validation group does only contain two common accounting equivalence validations. The first one is 'cae_AssetsLiabilitiesEquity' which ensures the following equation:

$$\text{Assets} = \text{Liabilities} + \text{Equity}$$

The second validation rule 'cae_AssetsLiabilitiesNetEquity' is a variation of the above formula and does use the subtotal element *ifrs:NetAssetsLiabilities* instead of Assets and Liabilities.

$$\text{Assets (liabilities)} = \text{Equity}$$

There is a potential to implement further validation rules on monetary items within that bucket. For example validation checks of accounting ratios which must be within

a certain range. Those checks are not provided within this IFRS formula package because they require huge individual judgement and are considered more useful on the filer's level. Ratios might vary from company to company and industry to industry. Defining them on the top level is therefore questionable.

Technical description: The later of both formulae ('cae_AssetsLiabilitiesNetEquity') is also implemented through the calculation linkbase. Nevertheless it illustrates that the calculation linkbase can be replaced through the formula linkbase in total to have a single technology for data quality testing.

Positive / negative fact validation

This group of formulae will ensure that if a fact is expected to be reported as an amount greater or equal zero it is not negative and vice versa. All positive / negative formulae are identified through the Value assertion ID attribute equal to 'positive' or 'negative' within the formula linkbase. All positive / negative validations are stored in the physical file /2011-03-25/formula/for_ifrs-pos_2011-09-16.xml.

Business description: Most facts reported in the majority of taxonomies in XBRL should be 0 or positive. This is related to the credit or debit balance attribute set on a given concept. For example, due to the fact that 'Cost of sales' has a debit balance attribute it should be reported as a positive number. It has been noted however, that there are a number of filings that are not obeying such logic. As reporting negative 'Cost of sales' is invalid, this formula will indicate such a case. It should be noted that the formula takes special cases into consideration. For example, Revenue in general should be positive unless reported qualified by the 'Elimination of intersegment amounts [member]' of the 'Operation segments [axis]'.

Technical description: For all applicable positive / negative validation formulae concepts – member combinations are either explicitly or implicitly stated in the variable 'pos' / 'neg'. The formula will only be validated if stated concepts are non-dimensional or used in combination with an axis defined in the IFRS schema. Certain primary items –member combinations are excluded from this test which can also be found in the mentioned 'pos' / 'neg' variables. *Complementary* filters state that this particular primary item - member combination is excluded from the validation. The extensive use of pre-conditions has been avoided wherever possible for the reason of performance, and an equivalent complementary filter has been used.

Percentage warning

This formula will ensure that the data format of a percentage fact is appropriate according to the XBRL specification.

The percentage warning formula is identified through the value assertion ID attribute 'percentage' within the formula linkbase. All percentage validations are stored in the physical file /2011-03-25/formula/for_ifrs-per_2011-09-16.xml. Percentage values are required to be in .xx format as defined in the XBRL 2.1 specification section 4.8.2.

To represent rates, percentages or ratios where the numerator and the denominator would be the same units, the fact MUST have a unitRef attribute identifying a unit element with a single measure element as its only child. The local part of the measure MUST be "pure" and the namespace prefix MUST resolve to the namespace:

"http://www.xbrl.org/2003/instance". Rates, percentages and ratios MUST be reported using decimal or scientific notation rather than in percentages where the value has been multiplied by 100.

Analysis has shown that a lot of filers do not apply this rule. The formula can be perceived as a warning rather than an error. It may well be that facts exceed the 100% mark which would result in a fact value *1.54* which is equivalent to 154%. This would not be an error and conforms to XBRL.

Technical description: The value is stored in the fact variable called '*percentage*'. This formula is applied to all percentage concepts in the DTS and is not limited to IFRS concepts.

Software packages which do provide formula linkbase support

Some software packages which can be used to execute this formula linkbase:

- [Fujitsu formula editor](#) (version 15)
- [Arele](#) (version 2011-08-16)
- [Reporting Standard XBRL Processor](#) (version 2.7.3)
- [UBmatrix Taxonomy Designer](#) (version 7)